

# Deep Inguinal Ring Medial to the Inferior Epigastric Vessels: A Novel Finding

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**Abstract:** The deep inguinal ring is a critical anatomical landmark in groin hernia repair and is classically described as an opening in the transversalis fascia located lateral to the inferior epigastric vessels. Variations in its position have been reported; however, a relationship in which the ring lies medial to the inferior epigastric vessels has not previously been described. We report a rare anatomical finding observed during routine cadaveric dissection of a male specimen. The specimen was sectioned transversely at the level of the iliac crest and sagittally through the pubic symphysis and linea alba, preserving the lower left anterior abdominal wall. Upon dissection of the inguinal region, the deep inguinal ring was identified medial to the inferior epigastric vessels and within the boundaries of Hesselbach's triangle. The spermatic cord structures traversed this opening and followed the expected course through the inguinal canal. Macroscopic examination demonstrated preserved continuity of the surrounding transversalis fascia, and no hernia sac or herniated tissue was identified. Because no clinical or demographic information was available, the origin of this configuration could not be determined and a previously acquired pathological process cannot be completely excluded. Recognition of such an anatomical variation may be important during radiological evaluation and open, laparoscopic, or robotic groin surgery, where the inferior epigastric vessels are routinely used as landmarks for hernia classification and operative planning. To our knowledge, this finding has not been previously documented in the literature.

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## 1. Introduction

The deep inguinal ring is a critical surgical landmark in both open and laparoscopic groin hernia repair and is classically described as an opening in the transversalis fascia located lateral to the inferior epigastric vessels, near the midpoint between the anterior superior iliac spine (ASIS) and the pubic tubercle (PT) [1]. Although commonly regarded as a fixed anatomical structure, previous studies have demonstrated variability in its location, particularly in patients with indirect inguinal hernias. Conaghan et al. reported that the deep inguinal ring may be located at approximately 41% of the PT-ASIS distance, while Sanjay et al. demonstrated positional deviations associated with indirect hernias [2,3].

Previous reports have primarily focused on variation in relation to the femoral vessels or surface anatomical landmarks. To our knowledge, no study has documented a deep inguinal ring located medial to the inferior epigastric vessels. This relationship is particularly relevant because the inferior epigastric vessels serve as one of the principal



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anatomical landmarks used to distinguish direct from indirect inguinal hernias and to guide preperitoneal dissection during minimally invasive hernia repair [4].

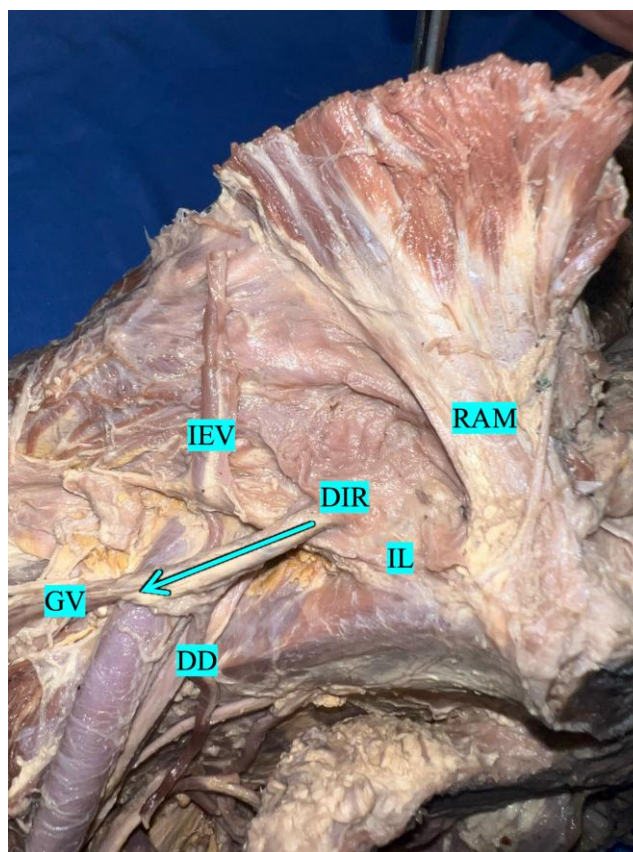
We describe a rare cadaveric finding in which the deep inguinal ring was located medial to the inferior epigastric vessels and within Hesselbach's triangle. Awareness of such anatomical deviations may improve anatomical education, surgical planning, and interpretation of imaging studies involving the groin region.

## 2. Case Report

During routine dissection of a male cadaveric specimen, an atypical configuration of the deep inguinal ring was observed. The specimen consisted of a left lower-limb block sectioned transversely at the level of the iliac crest and sagittally through the pubic symphysis and linea alba. This preparation preserved the lower portion of the left rectus abdominis muscle and its sheath, maintaining the anatomical integrity of the medial boundary of Hesselbach's triangle and adjacent structures. Dissection was initiated at the femoral triangle and progressed proximally toward the anterior abdominal wall. After identification of the superficial inguinal ring and reflection of the superficial tissue planes, the inguinal canal was explored from its posterior aspect. Reflection of the parietal peritoneum exposed the deep inguinal ring.

Unexpectedly, the deep inguinal ring was identified medial to the inferior epigastric vessels. Further dissection demonstrated that the opening was located within the anatomical limits of Hesselbach's triangle. The spermatic cord structures, including the ductus deferens and gonadal vessels, traversed this opening and followed the expected course through the inguinal canal (Figure 1).

**Figure 1.** Internal view of the anterior abdominal wall demonstrating the deep inguinal ring (DIR) located medial to the inferior epigastric vessels (IEV) and within Hesselbach's triangle. The ductus deferens (DD) and gonadal vessels (GV) are seen traversing the opening. RAM: rectus abdominis muscle; IL: inguinal ligament.



The inferior epigastric vessels were traced to their origin from the external iliac vessels and demonstrated the expected anatomical course without evidence of anomalous origin or displacement. Macroscopic examination revealed preserved continuity of the transversalis fascia surrounding the opening. No hernia sac, herniated abdominal contents, or obvious signs of previous surgical intervention were identified. Histological evaluation was not performed. Because the specimen was obtained through anonymous donation, no clinical history, demographic information, or prior imaging studies were available.

### 3. Discussion

The deep inguinal ring is traditionally described as an opening in the transversalis fascia situated lateral to the inferior epigastric vessels and serving as the entrance of the spermatic cord into the inguinal canal. Numerous anatomical studies have demonstrated variability in its location relative to surface landmarks. Conaghan et al. [2] reported substantial variation in the position of the deep ring, whereas Sanjay et al. [3] demonstrated positional deviations in patients with indirect inguinal hernias. Nevertheless, the relationship observed in the present case, namely a deep inguinal ring located medial to the inferior epigastric vessels, has not previously been reported.

The present finding challenges the traditional anatomical distinction between direct and indirect inguinal pathways, which relies heavily on the position of the inferior epigastric vessels. Classically, structures passing lateral to these vessels are considered indirect, whereas protrusions medial to them are considered direct. In this specimen, however, spermatic cord structures entered the inguinal canal through an opening situated within Hesselbach's triangle, creating an unusual anatomical configuration that does not fit neatly within conventional descriptions.

The precise origin of this finding remains uncertain. Although it may represent an anatomical variation arising during development of the inguinal canal, the available specimen does not permit investigation of embryological mechanisms. Furthermore, because no clinical history was available, it is not possible to definitively determine whether the observed configuration represents a congenital anatomical variation or the sequela of a previous acquired pathological process. Consequently, the present report is limited to documenting the observed anatomy and discussing its potential clinical implications.

From a surgical perspective, this variation may be particularly relevant during laparoscopic and robotic groin hernia repair. Procedures such as transabdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) repair rely heavily on the inferior epigastric vessels for orientation and classification of groin defects. In standard anatomy, these vessels also contribute to defining the spatial relationships of the Triangle of Doom and Triangle of Pain [5]. Encountering a deep inguinal ring medial to the inferior epigastric vessels could potentially alter the surgeon's interpretation of local anatomy and lead to inappropriate dissection, mesh positioning, or fixation.

Recognition of this possibility emphasizes the importance of meticulous preperitoneal dissection and complete identification of all relevant anatomical structures before mesh deployment. If encountered intraoperatively, such a variation highlights the need for individualized dissection and careful mesh placement based on the actual anatomical relationships identified during surgery, particularly to avoid neurovascular injury. A thorough understanding of local anatomy remains essential for safe and effective hernia repair [6]. In addition to surgical implications, this variation may also influence radiological interpretation. Computed tomography and ultrasonography frequently rely on expected anatomical relationships when evaluating the groin region. Awareness of atypical relationships between the deep inguinal ring and inferior epigastric vessels may therefore reduce the risk of diagnostic misclassification.

#### 4. Conclusion

We report a rare anatomical finding in which the deep inguinal ring was located medial to the inferior epigastric vessels and within Hesselbach's triangle. Although the precise origin of this configuration cannot be determined from the available specimen, recognition of such atypical anatomy is important because it may influence anatomical interpretation, hernia classification, radiological assessment, and operative decision-making. Further anatomical investigations are required to determine the prevalence and developmental basis of this finding.

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**Conflicts of Interest:** All other authors declare no conflicts of interest.

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